**Before the**
**FEDERAL COMMUNICATIONS COMMISSION**
**Washington, D.C. 20554**





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| In the Matter of | ) | |
| | ) | |
| Amendment of the Commission's Rules to Establish Rules and Policies Pertaining to a Mobile Satellite Service in the 1610-1626.5/2483.5-2500 MHz Frequency Bands | ) | CC Docket No. 92-166 |

**REPORT AND ORDER**

Adopted: October 13, 1994 Released: October 14, 1994

By the Commission:

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Appendix A
Appendix B

## I. INTRODUCTION

1. By this Report and Order, the Commission takes the next step in the process of licensing the world's first commercial low-Earth orbit (LEO) satellites capable of providing both voice and data mobile satellite services (MSS) on a global basis. The satellites are to operate in the 1610-1626.5/2483.5-2500 MHz bands that were recently allocated both internationally and domestically to MSS.[1] This new mobile satellite service -- the "MSS Above 1 GHz" or "Big LEO" satellite service -- has the potential to provide not only a variety of new services to users in the United States, but to provide integrated communication services to all parts of the world, including those that are now grossly underserved. In a Notice of Proposed Rulemaking (Notice), adopted in January 1994,[2] the Commission proposed rules and policies to govern the service. Thirty-three parties filed comments in response to the Notice and 18 parties filed reply comments.[3] Since the pleading cycle closed, four of the applicants filed a Joint Proposal and Supplemental Comments (Joint Proposal).[4] A fifth applicant sent a letter to the Chairman (FCC) on September 14, 1994 regarding the Joint Proposal.[5] In this Report and Order, we adopt many of the proposals in the Notice, adopt others with modifications, and defer action on several issues where a decision is premature. We also adopt many, but not all, of the terms of the Joint Proposal. We believe our decision will promote participation by the greatest number of applicants in an expeditious time frame.[6] It will create a new industry providing enormous economic benefit to the United States, and any other country that chooses to participate in the service.

2. All six applicants who filed applications by the cut-off date, as detailed below, will be provided with an opportunity to file amended applications that conform with the rules adopted today. Given the importance of proceeding quickly with licensing systems in this revolutionary service, amended applications must be filed by November 16, 1994 in order to receive continued consideration. As is our usual practice in the satellite area, each applicant must request construction, launch and operating authority to retain its status in this processing group. All

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[1] International Telecommunication Union, Final Acts of the World Administrative Radio Conference (WARC-92), Malaga-Torremolinos (1992); Report and Order, ET Docket No. 92-28, 9 FCC Rcd 536 (1994) (Allocation Order).

[2] Amendment of the Commission's Rules to Establish Rules and Policies Pertaining to a Mobile Satellite Service in the 1610-1626.5/2483.5-2500 MHz Frequency Bands, 9 FCC 2d 1094 (1994).

[3] A list of commenters is attached as Appendix A.

[4] See note 23, infra.

amendments must be accompanied by the appropriate fee for applications for launch and operating authority for LEO satellite systems, if that fee has not yet been submitted. Applicants will be provided until January 31, 1996, at their option, in which to make a complete financial showing.[7]

3. As described in the Notice, the Big LEO service can offer an almost limitless number of services, including ubiquitous voice and data mobile services, position location services, search and rescue communications, disaster management communications, environmental monitoring, paging services, facsimile transmission services, cargo tracking, and industrial monitoring and control.[8] Domestically, this service will help meet the demand for a seamless, nationwide and eventually global communications system that is available to all and that can offer a wide range of voice and data telecommunication services. In addition to enhancing the competitive market for mobile telecommunication services in areas served by terrestrial mobile services, this new mobile satellite service will offer Americans in rural areas that are not otherwise linked to the communications infrastructure immediate access to a feature-rich communications network. Moreover, Big LEO systems can extend these benefits throughout the world, and can provide those countries that have not been able to develop a nationwide communication service an "instant" global and national telecommunication infrastructure.[9] This network can be used to provide both basic and emergency communications to their entire populations. Big LEO systems may prove to be a critical component in the development of the global information highway.

4. The Big LEO service also has the potential to stimulate significant economic growth both in the United States and abroad. A potential multi-billion dollar industry will be created, generating opportunities for economic growth in a variety of markets. First, the estimated costs to construct the applicants' space segments range from $97 million to over $2 billion each. The manufacturing costs for the ground segment, which include both user units and gateway stations, are expected to be hundreds of millions of dollars more. Thus, manufacturing these systems may lead to a substantial investment in the United States economy and create a significant number of high paying jobs in the areas of research and development, production, marketing and service administration. As the services become available, additional growth opportunities will be created. One of the applicants, for example, expects that by 2001 the demand for user transceivers will be 1.3 million in the United States and 4.7 million worldwide.[10] If so, this will create a major global industry whose function will be to provide users with mobile units and services. As demand grows and as markets develop, additional

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[7] See para. 40, infra.

[8] See paras. 196-202, infra, regarding the use of Big LEO systems for emergency communications.

[9] It is estimated that some of these services will cost as little as 22 cents per minute.

[10] Application of Motorola Satellite Communications, Inc. at 11.

employment opportunities will be created. Customer purchases of transceivers and user service charges will generate additional investment in the economies of the host countries. Finally, the enhanced communications services offered by this industry will, of themselves, create a broad secondary economic growth. Immediate access to an advanced global communications infrastructure can increase the efficiency of existing businesses and create new ones.

5. The United States has led the world in developing and implementing satellite technology. We expect many of the economic, cultural and other gains we have seen in the fixed-satellite industry to be reflected in the new mobile satellite industry. The Big LEO proposals before us represent an opportunity for the United States to continue its leadership role in promoting global development through enhanced communication infrastructures and services. We intend to license these systems as quickly as possible so that this opportunity is not lost.

## II. BACKGROUND

6. As described in the Notice,[11] this proceeding was initiated in late 1990, when Ellipsat Corporation (Ellipsat)[12] and Motorola Satellite Communications, Inc. (Motorola) filed applications to construct LEO satellite systems in the 1610-1626.5/2483.5-2500 MHz bands and the 1610-1626.5 MHz band, respectively.[13] At the time these applications were filed, there was no frequency allocation in these bands for MSS. The bands were allocated to, among other services, the radiodetermination satellite service (RDSS), which encompasses satellite radionavigation and radiolocation services.[14] The Motorola and Ellipsat systems were intended to provide voice and data MSS in addition to RDSS. Both applicants requested waivers of the

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[11] See Notice, note 2, supra, at paras. 5-9.

[12] Ellipsat is now doing business as Mobile Communications Holdings, Inc. Because it has participated throughout this proceeding as Ellipsat, we will continue to refer to it as Ellipsat in this Report and Order.

[13] Ellipsat proposed the 1.6 GHz band for Earth-to-space transmissions and the 2.4 GHz band for space-to-Earth transmissions. Motorola proposed to use the 1.6 GHz band for bidirectional transmissions. Motorola later modified its application to request the 1616-1626.5 MHz band only. See Minor Amendment filed by Motorola (Aug. 14, 1992).

[14] Portions of the bands are also allocated to the aeronautical radionavigation service (ARNS), the radioastronomy service, the terrestrial fixed-service and for use by industrial, scientific, and medical equipment. See paras. 98-162, infra, for a complete discussion of sharing between MSS and other allocated services.

U.S. Table of Frequency Allocations, 47 C.F.R. § 2.1, to permit non-conforming MSS operations in the bands.[15]

7. The Commission placed the Ellipsat and Motorola proposals on public notice and established a June 3, 1991 cut-off date for filing applications to be considered concurrently with them.[16] In response, Constellation Communications, Inc. (Constellation), Loral Cellular Systems Corp., now doing business as Loral Qualcomm Partnership (LQP), TRW, Inc. (TRW), and AMSC Subsidiary Corporation (AMSC) filed applications. Constellation, LQP, and TRW proposed to construct LEO satellite systems. AMSC proposed to add additional frequencies onto its authorized geostationary satellite-orbit (GSO) system.[17] The LEO applicants proposed two basic LEO system architectures. TRW, LQP, Ellipsat, and Constellation proposed a code division multiple access (CDMA) architecture. CDMA systems can share the same frequencies when operating under certain technical constraints.[18] Motorola proposed a time division multiple access/frequency division multiple access (TDMA/FDMA) architecture. TDMA/FDMA systems must operate on separate dedicated frequencies.[19] AMSC's proposed GSO system could use either CDMA or narrowband FDMA techniques.

8. The World Administrative Radio Conference (WARC-92), allocated frequencies for MSS in February 1992.[20] Specifically, the 1610-1626.5 MHz band was allocated on a co-primary basis with other radio services for MSS Earth-to-space operations and the 2483.5-2500

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[15] These waiver requests have become moot in light of the subsequent domestic and international MSS allocation in these bands. See note 1, supra.

[16] Public Notice, Report No. DS-1068, 6 FCC Rcd 2083 (1991).

[17] AMSC requested authority to modify its authorized upper L-band (1545-1559/1646.5-1660.5 MHz) MSS system to include the 1616.5-1626.5 MHz frequency bands.

[18] Spread spectrum CDMA is a digital transmission technique in which the signal occupies a bandwidth larger than that needed to contain the information being transmitted. Because the signal is spread over a wide bandwidth, the power is dispersed and interference potential is reduced. The spreading is accomplished by modulating the signal by a code that is independent of the information data. A synchronized code in the receiver is used to de-spread the signal and recover the information. The spreading and the variation in the code permit a number of users to operate on the same frequency simultaneously without causing harmful interference.

[19] TDMA is a transmission technique in which the same frequency band is used by both uplink and downlink transmissions in alternating time slots. FDMA provides multiple discrete channels with different center frequencies.

[20] See note 1, supra.

MHz band was allocated on a co-primary basis for space-to-Earth operations.[21] In addition, a secondary allocation was made for MSS space-to-Earth operations in the 1613.8-1626.5 MHz segment of the 1.6 GHz band. Shortly thereafter, the Commission proposed an identical domestic allocation and subsequently adopted that allocation in December 1993.[22]

9. The Commission conducted a negotiated rulemaking from January through April 1993 to assist it in developing technical rules for the MSS Above 1 GHz service. The Negotiated Rulemaking Committee's (the Committee's) work included technical matters relating to compatibility among the proposed MSS systems (inter-system sharing issues), compatibility between MSS and other services in the band or in adjacent bands (inter-service sharing issues), and the operations of MSS feeder links and intersatellite links. The Committee reached consensus on many issues, but did not reach a consensus regarding a technical method by which all proposed systems could be accommodated within the 1610-1626.5/2483.5-2500 MHz bands.[23]

10. In January 1994, the FCC adopted the Notice proposing, among other things, a LEO design requirement, a requirement that systems be capable of serving all areas of the world (except for the polar regions) for at least 75% of each day, a requirement that systems be capable of serving all areas of the United States at all times, and a requirement that applicants demonstrate sufficient current assets or irrevocably committed financing to meet construction and launch costs for the entire system. We also proposed a spectrum sharing plan that could accommodate up to five systems. We indicated that if mutual exclusivity could not be resolved, we would consider awarding licenses by auction, lottery or comparative hearing.[24]

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[21] "Primary" services have equal rights to operate in particular frequencies. Stations operating in primary services are protected against interference from stations of "secondary" services. Moreover, stations operating in a secondary service cannot claim protection from harmful interference from stations of a primary service. See 47 C.F.R. §§ 2.104(d) and 2.105(c).

[22] See note 1, supra.

[23] See Report of the MSS Above 1 GHz Negotiated Rulemaking Committee (Apr. 6, 1993). The Committee included two independent attachments discussing this issue in the Report. One was supported by AMSC, Celsat, Inc., Constellation, Ellipsat, LQP and TRW. The other was supported by Motorola. Since the end of the Negotiated Rulemaking, the LEO applicants have submitted several partial settlement proposals. See Joint Filed Comments, submitted by Motorola and LQP (Oct. 7, 1993); Joint Spectrum Sharing Proposal, submitted by Constellation, Ellipsat and TRW (Oct. 8, 1993). Joint Proposal and Supplemental Comments submitted by Constellation, Ellipsat, Motorola, and TRW (Sept. 9, 1994). See also letter from LQP to FCC (Sept. 13, 1994).

[24] Notice, note 2, supra, at paras. 29-47.

## III. DISCUSSION

### A. Licensing Procedures

#### 1. Qualification Requirements

11. As discussed in the Notice, unless otherwise proscribed by rule, statute or treaty, the Commission has traditionally adopted qualification requirements for each satellite service that reflect the nature of and entry opportunities for the particular service being licensed. Where entry opportunities for a particular service are limited, our threshold qualification requirements for that service are designed to ensure that those awarded licenses can expeditiously implement state-of-the-art systems that further the public interest. If applicants are unable to meet the basic qualifying criteria, their applications are dismissed without additional hearing.

##### a. Technical Qualifications

###### i. Orbit Considerations

12. In the Notice, we proposed to require MSS Above 1 GHz systems to operate in non-geostationary orbits.[25] Because of their lower altitude orbits, LEO systems "can shorten the transmission time between two earth stations, serving to reduce or eliminate the time delay that may now be present in [GSO] satellite-delivered telephone service."[26] We also stated that the Communications Act specifically requires us "to encourage the provision of new technologies and services to the public."[27] We noted that LEO satellite systems, which cover higher latitudes than GSO satellites, and provide a variety of low power links to and from terrestrial equipment, represent such a new technology. We also noted that the inherently global nature of LEO systems offers a broad range of public interest benefits for the United States, including increased possibilities of U.S. leadership in developing and implementing satellite technology, and enhanced U.S. global competitiveness in telecommunication. We suggested that the unique features of LEO systems would foster social and economic benefits throughout the world.

13. We requested comment on the potential for MSS Above 1 GHz systems to generate social, economic, and technical benefits, both domestically and globally, and the extent to which these benefits are realizable with LEO and GSO satellites. We also asked applicants to specify the extent to which their proposed systems will foster these goals and the manner in which their services are planned to be offered. Prospective customers were asked to specify their anticipated use or uses of MSS Above 1 GHz systems, including a discussion of whether equivalent services

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[25] Id. at paras. 20-22; proposed § 25.143(b)(1).

[26] Id. at para. 22.

[27] 47 U.S.C. § 157.

can be provided by LEO and GSO facilities and whether, and the extent to which, alternative terrestrial services are available.

14. AirTouch Communications (AirTouch), Constellation, Ellipsat, LQP, Motorola, Novacom Inc. (Novacom), and TRW support our proposal to require MSS Above 1 GHz systems to operate in LEO orbits. The range of technical benefits to the United States and world communities by LEO systems includes virtually instantaneous voice transmissions, broader geographic coverage, use of low power handheld transceivers and small antennas. AMSC, Comsat, Mobile Communications (Comsat), Mobile Datacom Corporation (Mobile Datacom), and Newcomb Communications, Inc. (Newcomb) do not support our proposal. They argue that there will be no significant qualitative or quantitative difference in the time delay experienced by users of GSO and non-GSO systems and that GSO systems are capable of providing services to most of the Earth. They further argue that LEO technology is subject to shadowing outages,[28] is more complex , and is unproven.

15. We adopt our proposed LEO design requirement. First, AMSC has not convinced us that our assumption regarding the time delay in high altitude GSO systems was in error. While system processing times associated with non-GSO satellite handoffs may be marginally longer than the 18 milliseconds noted by LQP, AMSC has not shown that a GSO system's typical voice transmission delay of some 250 milliseconds, or even longer for multiple hops, is not noticeable to users.

16. Further, LEO systems are significantly superior in their coverage capabilities. While GSO systems can provide coverage to most of the world, this coverage is limited in areas of high latitude, including parts of Alaska. AMSC concedes that GSO systems can provide only "near" total coverage of the Earth. Although GSO systems are capable of providing acceptable services across most of the Earth's surface, LEOs are capable of providing truly global coverage. LEO technology, for example, may enable residents of remote parts of Alaska to have individual telephone access for the first time. There is nothing in the record to suggest that provision of such broad geographical service reduces the capacity of LEO systems to serve more concentrated areas, as AMSC suggests. The public interest would be best served by the technology that offers the broadest potential coverage.

17. The use of handheld transceivers also is facilitated by LEO systems. LEO satellites' lower power levels alleviate the need for large antennas aboard the spacecraft and reduce transceiver weight and volume, enhancing their portability. By contrast, AMSC suggests that handheld transceivers are not contemplated by GSO systems.[29] Its immediate plans do not

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[28] Shadowing occurs when transmissions from the satellite or mobile transceivers are blocked by buildings and vegetation. Shadowing also occurs to GSO systems when the user transceiver terminal is located on a vehicle.

[29] AMSC Reply Comments at 3, n. 1.

include handheld capability, though its second generation system is expected to support them. [30] As we embark on the promise of new mobile technologies, we find it in the public interest to permit the timely deployment of personal communications services that include the broad use of handheld transceivers.

18. One risk cited by AMSC is the increased possibility that the satellites in the LEO constellation will collide with other objects in space. We do not view this as stifling LEO technology. Both the likelihood of collisions and future mitigation methods are being discussed in domestic and international fora. However, the record in this proceeding does not support a finding that space collisions will become a significant problem for LEO systems. We also acknowledge that the reception shadowing associated with LEO satellite movement relative to the Earth's surface (which AMSC suggests would adversely affect signal quality during voice communications) may add to the operational challenges confronting LEO MSS technology. There is no showing, however, that shadowing is more of a problem with LEO technology than it is with GSO technology.

19. Advocates of both GSO and LEO systems argue that their technology will offer economic and social benefits, domestically and globally. The essential advantage of GSO systems is their proven capability to provide telecommunication services. Intelsat and Inmarsat are but two examples. These successes, however, are not sufficient to preclude embracing a new and potentially more efficient technology, notwithstanding its substantial risks and costs. On the contrary, the Commission has a mandate to encourage new technologies and services.[31] While both LEO and GSO systems portend substantial opportunities for employment growth and export of U.S. technologies worldwide, LEO systems have greater potential to serve more uniformly the United States and international locations with smaller, more ubiquitous and lower power equipment. This leads us to conclude that the primary use of the subject spectrum should be by LEO systems. We therefore adopt Section 25.143(b)(2)(i) as proposed in the Notice.

20. Most commenters agree that it would it be difficult for GSO and LEO systems to operate MSS services together in this band. Indeed, this was a significant factor in our decision to propose limiting the 1610-1626.5/2483.5-2500 MHz band to LEO systems. Notwithstanding our decision to adopt a LEO design requirement, we would consider authorizing a GSO system in these bands upon a showing that its operations would not cause interference to or affect LEO operations. Similarly, the provision of radiodetermination satellite services (RDSS) by either LEO or GSO systems would be permissible if fully compatible with licensed LEO MSS systems.[32]

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[30] Id.

[31] 47 U.S.C. § 157.

[32] See 47 C.F.R. § 25.141(f).

ii. Global vs. Regional Coverage

21. In our Notice, we discussed the geographic coverage we would require these satellite systems to provide. In view of our interest in furthering the creation of the global information infrastructure, we proposed to require each MSS Above 1 GHz applicant to demonstrate that its proposed system is capable of providing mobile satellite service to all areas of the world, with the exception of the polar regions, for at least 75% of every 24 hour period. Specifically, we proposed that Big LEO satellite systems be designed so that at least one satellite would be visible above the horizon at an elevation angle of at least 5° for at least 18 hours each day at latitudes less than 80°.[33]

22. The commenters generally support this requirement. They disagree, however, on the extent to which systems must offer service in or near the polar regions. The majority, including the system applicants, agree that there is little need for a requirement to serve unpopulated areas. They argue that the additional costs associated with such service would not be justified. For example, TRW suggests that service up to 80° northern and southern latitudes may not be necessary, because there are no populated areas that far north or south and the economic costs of requiring such service are high. Ellipsat favors requirements of 55° Southern Latitude and 75° degrees Northern Latitude, to cover all but the most remote population centers. The parties to the Joint Proposal modify their previous positions by suggesting a coverage requirement of up to 70° North Latitude and 55° South Latitude.

23. As noted, LEO systems are capable of providing service to all points on Earth. We recognize, however, the need to balance system cost against geographical service area. We agree with the commenters that it is sufficient, given projected need and alternative service options, to require service only to populated areas. We therefore require that Big LEO systems be capable of serving locations as far north as 70° latitude and as far south as 55° latitude. This will allow coverage to populated areas that cannot be reached by GSO systems. While ships and airplanes may traverse the polar regions beyond these latitudes, they are not necessarily deprived of service because the LEO satellites may, in fact, be visible.

iii. Continuous Coverage of the Fifty States

24. We indicated in the Notice that the public interest would be served if LEO systems provided efficient and ubiquitous voice service to users throughout the United States. We therefore proposed to require each LEO system to have at least one satellite at an elevation angle of at least 5° at any given time in all areas of the United States.[34]

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[33] See Notice, note 2, supra, App. A at 1152; proposed Section 25.143(b)(2)(ii).

[34] See id.; proposed Section 25.143(b)(2)(iii).

25. Several commenters note that we proposed to require global "mobile satellite services" in proposed Section 25.143(b)(2)(ii) and domestic "voice" service in proposed Section 25.143(b)(2)(iii). Our expectation is that LEO system operators will have market incentives to offer more than merely voice services, but for purposes of consistency we will revise proposed Section 25.143(b)(2)(iii) to read "mobile satellite services." Further, in the Joint Proposal, the parties agree that Big LEO systems should be capable of covering all fifty states, Puerto Rico and the U.S. Virgin Islands. We will amend Section 25.143(b)(2)(iii) to reflect this coverage.

b. Financial Qualifications

26. In light of the enormous costs involved in constructing and launching a satellite system, we have always considered financial ability a significant factor in determining whether an applicant is qualified to hold a license. Historically, the Commission has fashioned financial requirements for satellite services on the basis of entry opportunities in the particular service being licensed. This stems from our repeated experience that licensees without sufficient available resources spend a significant amount of time attempting to raise the necessary financing and that those attempts often end unsuccessfully.[35] Consequently, where a grant to an under-financed applicant may preclude a fully capitalized applicant from implementing its plans, and service to the public may be consequently delayed, we have required a stringent financial showing to ensure that the public interest would be served.[36] We have required a less stringent financial showing where grant to an under-financed applicant will not prevent another from going forward. For example, we required only a detailed business plan in the radiodetermination satellite service, where all applicants could be accommodated and future entry was possible.[37] In contrast, we required evidence of full, irrevocable financing in the domestic-fixed satellite service, where

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[35] See, e.g., National Exchange Satellite, Inc., 7 FCC Rcd 1990 (Com. Car. Bur. 1992); Rainbow Satellite, Inc., Mimeo No. 2584 (Com. Car. Bur., released Feb. 14, 1985); United States Satellite Systems, Inc., Mimeo No. 2583 (Com. Car. Bur., released Feb. 14, 1985) (domestic satellite licenses declared null and void for failure to begin implementation as required by license). In addition, Geostar Corporation, a start-up company licensed in the radiodetermination satellite service, declared bankruptcy nearly five years after its licenses were issued. It had not built any of its satellites.

[36] This approach has not prevented smaller firms from participating in the satellite services market because ownership of a space station is not mandatory. Space station capacity can be leased or bought, and earth stations can be acquired at relatively low costs.

[37] Amendment of the Commission's Rules to Allocate Spectrum for, and to Establish Other Rules and Policies Pertaining to, a Radiodetermination Satellite Service, 104 FCC 2d 650 (1986) (RDSS Licensing Order). We note that none of the four entities awarded licenses implemented their proposed systems, with the last remaining licensee, Geostar Corporation, declaring bankruptcy in 1991.

applications to implement space stations regularly exceed the number of available orbital locations for those satellites.[38]

27. The Negotiated Rulemaking Committee could not agree to a method by which all six proposed systems could be licensed. Further, the sharing plan we proposed in the Notice, and which we adopt today,[39] does not accommodate all pending applicants and leaves little or no spectrum available for expansion of existing systems or the development of future MSS systems within the United States. Consequently, consistent with our past practice, we seek to ensure that those applicants awarded Big LEO licenses have the financial ability to proceed.

28. The domestic fixed-satellite standard was developed to serve the public interest by deterring warehousing and inefficient use of valuable orbit spectrum resources. Given the same public interest concerns here, we proposed in the Notice a financial standard for the Big LEO service identical to the one used in the domestic fixed-satellite service, noting that a lesser standard could allow permittees to tie up scarce spectrum resources while preventing other qualified entities from providing service to the public.[40] Thus, we proposed to require Big LEO applicants to provide evidence of current assets, operating revenues, or irrevocably committed debt or equity financing sufficient to meet the estimated costs of constructing and launching all planned satellites, and operating the system for the first year.[41]

29. The four parties to the Joint Proposal suggest using a less stringent financial standard that requires an applicant to show "financial preparedness, including reliance on projected revenues and future public offerings" in order to be granted a construction permit. Within one year from the date of the grant of a license, each permittee would be required to demonstrate that it meets the domestic fixed-satellite service financial standard with respect to 25% of the total constellation construction and launch costs. LQP, in contrast, argues that this proposed relaxation of financial standards must be balanced against the concern that only viable applicants be licensed.[42]

30. We conclude that although more relaxed approaches may be used for some satellite services, a strict financial requirement is warranted for the Big LEO service. The proposed Big

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[38] Licensing Space Stations in the Domestic-Fixed Satellite Service, 50 Fed. Reg. 36071 (Sept. 5, 1985) (1985 Processing Order).

[39] See paras. 44-45, infra.

[40] 1985 Processing Order, note 38, supra, at para. 8.

[41] Notice, note 2, supra, at para. 27. We noted that "first year operational costs" were to be calculated for the year following the launch of the first satellite in the constellation.

[42] See Letter from Chairman, Loral Corporation to Christopher B. Galvin, Motorola, Inc. (Sept. 13, 1994).

LEO systems will cost between $97 million and $2 billion to implement. These are, by far, the most expensive satellite systems to date. As we indicated in the Notice, our experience with the satellite industry has proven that arranging financing for any space station system, even one significantly less costly than a Big LEO system, is extremely difficult, even after a construction permit has been granted.[43] Consequently, adopting a lesser financial standard than the domestic fixed-satellite standard, such as the one suggested in the Joint Proposal, could tie up spectrum for years, with contrary to the public interest. While system implementation milestone requirements[44] will provide a mechanism by which to revoke the licenses of those entities that are not capable of going forward, this process takes considerable time and can delay qualified entities from implementing systems and providing service to the public.[45] Because all pending Big LEO applicants cannot be accommodated and because there appears to be no room for future entry, granting an under-financed space station applicant a license may preclude an applicant that possesses the necessary financial resources from implementing its plans, and consequently service to the public may be delayed. Accordingly, we conclude that a financial demonstration identical to the one used in the domestic fixed-satellite service, as proposed in the Notice, should be adopted for the Big LEO service.

31. Applicants relying on internal financing need not set aside specific funds for their systems. Rather, as in the domestic fixed-satellite service, we require only a demonstration of current assets or operating income sufficient to cover system costs. The availability of internal funds sufficient to cover a system's costs provides adequate assurance at the time the Commission acts on the application that the system can be built and launched. Current assets -- which includes cash, inventory, and accounts receivable -- provide a general measure of a company's ability to finance the project itself or to raise funds from lenders and equity investors on the basis of its on-going operations. Highly capitalized companies possess more collateral and, thus, are in a better position to borrow money than thinly capitalized companies.

32. Further, "irrevocably" committed external financing is financing that has been approved and does not rest on contingencies which require action by either party to the loan or equity investment. In other words, the instrument of financing must demonstrate that the lender

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[43] See note 35, supra.

[44] See paras. 188-193, infra.

[45] For example, ABCI, Rainbow, and USSSI were granted domestic fixed-satellite licenses in early 1983. Those licenses were not declared null and void until two years later, shortly before action was taken on the next processing group of domsat applications. Applications in that particular processing group had been on file since late 1983 and action on that group was delayed, in part, by the ABCI, Rainbow, and USSSI proceedings. See, e.g., United States Satellite Systems, Inc., FCC 83-602 (released Jan. 23, 1984) (granting USSSI an additional six months in which to complete its financing), Mimeo No. 2583 (released Feb. 14, 1985) (revoking USSSI authorizations), FCC 85-394 (released Aug. 29, 1985) (denying USSSI's applications for review).

has already determined that the applicant is creditworthy and, absent a material change in circumstances, is prepared to make the loan immediately upon grant of a Commission authorization.[46] This is not to preclude applicants from relying on operating revenues from the initial operations of their systems to finance the remainder of their systems. Nevertheless, to ensure that the system is completed in a timely manner if revenues are not available as soon as anticipated, we require a commitment that a lender is prepared to finance the entire cost of the system.

33. Some of the applicants argued in their comments[47] that a more relaxed standard is supported by our use of a less stringent financial requirement in the radiodetermination satellite service (RDSS) and the non-voice, non-geostationary (NVNG) service. These parties argue that the unproven nature of the RDSS and NVNG services led to the adoption of a financial standard that permitted applicants to finance the systems as they are built and deployed, and that similar considerations apply in the Big LEO service. Our primary reason for the "relaxed" standard in the RDSS and NVNG services, however, was that all pending applicants could be accommodated and future entry was possible.[48] Consequently, a grant to an under-financed applicant would not preclude another qualified entity from going forward. The financial qualification standard adopted for RDSS and NVNG services is therefore inappropriate for Big LEOs.

34. Some of the applicants also argue that we should require only a demonstration of partial financing. They contend that applicants that have the financing to meet construction and launch costs for the number of satellites needed to provide limited domestic and global service will be able to finance the remainder of their systems with the operating income from these services. Such a position, however, would not promote the global availability of this service. A system that relies too heavily on operating income from its first satellites for its completion could easily become stalled before it is able to provide domestic or global service that meets our service requirements.[49] Any applicant that cannot demonstrate the capability to launch more than a limited number of satellites should not be considered for licensing at the expense of potential entrants that could provide global service and continuous domestic service.

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[46] For example, a change in general market conditions or in the applicant's creditworthiness is an acceptable limitation on the lender's commitment to make the loan. Further, a lender is not required to lend the applicant the entire sum at once. Rather, funding can be staggered to reflect the system's implementation schedule or the applicant's need to access those funds. See Licensing Space Stations in the Domestic-Satellite Service, 101 FCC 2d 223 (1985) (1985 Processing Group Notice of Proposed Rulemaking), at para. 22.

[47] We will address all concerns raised in the comments even though they may be inconsistent with the positions taken by the applicants in the Joint Proposal.

[48] See Notice, note 2, supra, at 1108; RDSS Licensing Order, note 37, supra; Report and Order in CC Docket No. 92-76, 8 FCC Rcd 8450 (1993) (NVNG MSS Order).

[49] See para. 29, supra.

35. Ellipsat comments that we should require applicants relying on internal funds to demonstrate a management "commitment" to expend those funds for the Big LEO project. Ellipsat argues that this requirement would put companies with greater capital assets on an even footing with smaller applicants who must rely on "irrevocable" outside loan commitments to establish their financial qualifications. As we stated in adopting the domestic-fixed satellite standard, we will not require management to set aside specific funds for the system. We will, however, require applicants relying on internal assets to provide a balance sheet demonstrating current assets or operating income sufficient to meet the space segment costs together with evidence of a management commitment to the project. This does not require an unalterable commitment that the funds will be expended regardless of market conditions. Rather, consistent with our approach to credit arrangements provided by outside sources, management of the corporation providing the funding must commit that absent a material change in circumstances, it is prepared to expend the necessary funds.[50] Those applicants relying on financing from parent corporations must make the same showing with respect to the parent corporation's commitment.

36. AMSC urges that, given the short life of LEO satellites, we should require the applicants to demonstrate the financial capability to build an entire constellation and a fleet of replacement satellites. Although some of the proposed systems use satellites with a short life, a requirement to demonstrate full funding for these before the first generation is built would be exceptionally onerous and unnecessary. We are confident that after constructing and operating a full fleet of satellites, a licensee would have ample incentive and resources to implement replacement satellites, unless there is insufficient demand. In that case, however, the public would not be harmed by discontinuation of the licensee's service.

37. We recognize that applicants may be able to provide the service requirements adopted today with fewer satellites than proposed in the pending applications. In such a case, an applicant has the option, of course, to modify its pending application to specify only those satellites necessary to meet our minimum requirements, and its financial and technical showing would need to cover only such a constellation. It could then apply to expand its constellation as originally envisioned, as it attains the financial capability to do so.

38. Consequently, to meet the public interest objective of ensuring prompt initiation of this new satellite service, we adopt our proposed rule that requires each Big Leo applicant to demonstrate the ability to build and launch all satellites for which it has applied, which includes those satellites necessary to fulfill our service requirements, and to operate its system for one year after launch of the first satellite in its constellation. In doing so, however, we shall modify our eligibility requirements somewhat in an effort to achieve greater participation by the applicants in this processing group.

39. First, consistent with our paramount objective of securing early implementation of these satellite services, we shall adopt a rule, consistent with our proposal in the Notice, that will

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[50] See 1985 Processing Order, note 38, supra, at n. 26.

enable applicants who can now demonstrate their financial qualifications to receive priority in obtaining license grants. Thus, any applicant who can submit a complete, amended application on or before November 16, 1994, and demonstrates financial capability under the standards set forth in the rule adopted in this proceeding, will be processed immediately. Assuming sufficient spectrum is available to award licenses to all such financially and otherwise qualified applicants, we will grant licenses to these applicants. Given the the national and other public interest benefits of ensuring the United States' global leadership in providing these important new satellite services, we also plan to process these applications on an expedited basis, with action anticipated by January 31, 1995. Making these grants promptly will enable such fully qualified applicants to begin immediately the time-consuming process of satellite construction, thereby significantly assisting in United States' efforts to complete the international coordination process and achieving our statutory and public interest objective of bringing new and innovative services to the public at the earliest possible time.

40. We also wish, however, to accord some processing priority to other applicants in this group who may need more time to establish their financial qualifications, and who have all devoted significant time, effort and resources towards establishing the Big LEO service both domestically, in the Negotiated Rulemaking, and internationally. For example, until feeder link frequencies can be assigned to a particular system, which will not likely occur until after the next World Radio Conference to be held in November 1995 (WRC-95), it may be difficult for some of these applicants to finalize financial arrangements for their systems. Consequently, in an effort to afford an additional opportunity for entry by such applicants, we will allow applicants who cannot meet our financial qualifications requirement at this time an additional period of time to establish their qualifications. Specifically, we will require these applicants to file amended applications by November 16, 1994 to ensure their continued consideration, but we will allow them until January 31, 1996 -- two months after the completion of WRC-95 -- to demonstrate compliance with the financial standard adopted today.

41. Under our two-tiered eligibility rule, applicants who make a decision to defer their financial showing until January, 1996, will not jeopardize their status in the current processing group. Specifically, new applications for Big LEO systems will not be considered until after action on the six pending applications is completed. Nevertheless, such applicants will not be accorded the same processing priority as those applicants who are willing and able to demonstrate their financial qualifications far sooner, by November 16, 1994, and whose expeditious grants will better enable us to achieve early and successful international coordination and implementation of this service. Because the spectrum sharing plan we adopt today accommodates up to five systems,[51] we also recognize that applicants choosing not to make a financial showing until January 1996, may find their applications are mutually exclusive situation. Nevertheless, we believe a very significant likelihood exists that our financial eligibility rule will result in more of these applicants obtaining grants and that, in the intervening time frame until January 1996, events may occur that avoid mutual exclusivity altogether.

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[51] See paras. 44-45, infra.

42. If it turns out that all six applicants are able to estabish their financial qualifications by the November 16, 1994 deadline for amended applications, or alternatively, that all six applicants defer their financial showings until January 1996 and all are then deemed financially qualified, we will implement the auction procedure described below, paras. 88-97, to award licences. If, however, some grants have been made prior to January 1996, and a mutually exclusive situation arises then, the auction procedure outlined below cannot be used. However, given the uncertainty that such a situation will ever arise, we will not at this time decide how to process any such remaing mutually exclusive applications. Presumably, however, such grants would be awarded through an auction mechanism that is appropriate in the circumstances. We have decided, however, to defer any final decision on that issue at this time.

2. Spectrum Sharing Plan

a. Background

43. As we discussed in the Notice, the six applicants proposed two system designs (LEO and GSO) and two system architectures (CDMA and TDMA/FDMA). A CDMA architecture would permit multiple systems to share the same frequencies. A TDMA/FDMA architecture would operate bi-directionally in a portion of the 1.6 GHz band only and would require each system to operate on discrete frequency band segments. The Committee's work plan called for the Committee to develop rules that would maximize multiple entry and avoid or resolve mutual exclusivity among the six applications. The applicants, however, could not develop a set of technical parameters and sharing criteria that could accommodate all proposed systems. In the Notice, we proposed a sharing plan that could accommodate up to four CDMA systems and one TDMA/FDMA system.[52] The plan was based, in part, upon partial settlement proposals filed by two groups of LEO applicants after the Negotiated Rulemaking was concluded.[53] The plan proposed to assign licensees implementing CDMA systems in the United States to 11.35 MHz of shared bandwidth at 1610-1621.35 MHz. It proposed to assign a TDMA/FDMA system operating in the United States to 5.15 MHz of dedicated bandwidth at 1621.35-1626.5 MHz. If only one CDMA system is implemented, the plan proposed to adjust the domestic assignment for that system to 8.25 MHz at 1610-1618.25 MHz, leaving the freed 3.15 MHz of spectrum available for possible reassignment to the TDMA/FDMA licensee or for new entry. We also tentatively concluded that CDMA systems would be provided with equal amounts of downlink and uplink spectrum, unless CDMA system proponents could demonstrate an unequal assignment was warranted.

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[52] Our plan included both system architectures for two reasons: (1) the record did not support a finding that one architecture is superior to the other, and (2) the plan would permit up to five systems to be licensed, furthering our multiple entry policy.

[53] See note 23, supra.

b. The Basic Plan

44. All five applicants proposing LEO systems agree that our plan provides a basis for accommodating five LEO systems. None takes issue with the framework of the plan: up to four CDMA systems can share 11.35 MHz of bandwidth in the 1.6 GHz band and that one TDMA/FDMA system can operate over 5.15 MHz of dedicated bandwidth. Constellation, for example, states that 11.35 MHz can "support competitive CDMA systems operating in a sharing environment."[54] Motorola supports awarding a single TDMA/FDMA license in 5.15 MHz of bandwidth.[55] LQP, TRW, and Ellipsat all agree that both LEO transmission techniques can be accommodated, with CDMA systems operating on shared spectrum. Indeed, the four proponents of the Joint Proposal, supported by LQP, explicitly agree to an 11.35 MHz/5.15 MHz spectrum split.

45. Despite its general agreement that its system could be accommodated in 11.35 MHz of shared spectrum, Constellation contends in its comments that all five LEO applicants should be given equal options to use the spectrum. Specifically, it argues that adoption of rules requiring four LEO applicants share spectrum, while allowing the remaining applicant to have exclusive use of its own band segment or assigning prime spectrum to one applicant and impaired spectrum to another, would violate the doctrine enunciated in Ashbacker Radio Corp. v. FCC, 326 U.S. 327 (1945) (Ashbacker). We do not agree that a rule requiring sharing by applicants proposing CDMA systems, and that permits other applicants to have exclusive spectrum, implicates Ashbacker. Such a rule is merely a reasonable exercise of our rulemaking authority, based upon the technical characteristics of the systems involved. We also note that the CDMA applicants agreed to a band sharing plan. Indeed, Constellation agrees that its system can be accommodated in a shared band. Consequently, we adopt the plan's basic framework.[56]

46. Despite their general support for the plan, all LEO applicants request some modifications or clarifications. The requests center around three issues: (1) what portion of the 2.4 GHz MSS downlink band will be available to the CDMA licensees; (2) whether MSS operations in the lower 6 MHz of the 1.6 MHz band will be impaired by GLONASS, the Russian Global Navigation Satellite System, and radioastronomy service (RAS) operations in that band; and (3) whether the 11.35 MHz CDMA assignment will be automatically reduced to 8.25 MHz should only one CDMA system become operational. We discuss these in turn.

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[54] Constellation Comments at 19.

[55] Motorola Comments at 47, n. 35.

[56] See Final Report of the Majority of the Active Participants of Informal Working Group 1 to Above 1 GHz Negotiated Rulemaking Committee, Annex 1 (Attachment 1 to Committee Report) and Joint Proposal, note 23, supra.

c. Downlink Assignment

47. In the Notice, we assumed that CDMA systems assigned to share the 1.6 GHz uplink spectrum would require a corresponding amount of 2.4 GHz downlink spectrum. We requested comment on this assumption. All CDMA operators strongly disagree, arguing in their comments and in the Joint Proposal that CDMA applicants should be allowed to share the entire 16.5 MHz of 2.4 GHz downlink spectrum allocated to MSS. They argue that the systems must operate over the entire bandwidth to achieve maximum capacity at minimum cost. According to the CDMA proponents, if the number of satellites transmitting in any segment of the 2.4 GHz band is minimized, the satellites' cost can be substantially reduced. They also argue that the 2.4 GHz band is already constrained by international and domestic power flux density (pfd) limits and other existing services, which limits the number of users that can be served, and that any limitations on bandwidth will further affect system capacity.

48. We are convinced that the entire 16.5 MHz of spectrum allocated domestically and internationally at 2483.5-2500 MHz should be assigned to Big LEO system downlinks in the United States. There is no compelling reason to restrict use of this band. Indeed, assignment of the entire band should provide operators with sufficient flexibility to coordinate their operations with other Big LEO systems in the band and to accommodate other users in the band or in adjacent bands with little or no corresponding loss of capacity. Consequently, we will provide CDMA operators with access to the entire allocated 2.4 GHz band. Moreover, only satellite systems using CDMA will be permitted in this band.

d. Interim Plan

49. As we discussed in the Notice, interference problems between MSS and certain proposed applications on GLONASS, the Russian Global Navigation Satellite System, will not permit co-frequency co-system coverage in the United States and internationally in the 1610-1616 MHz band. Specifically, if GLONASS is used in conjunction with the U.S. Global Positioning System (GPS) to provide aircraft precision approach and terminal communications, as contemplated by the Federal Aviation Administration (FAA), MSS would not be able to operate in the shared band because of the potential for MSS mobile terminal interference into GLONASS mobile receivers.[57] We indicated in the Notice that we had initiated inter-agency and international

[57] The FAA and the International Civil Aviation Organization (ICAO) are investigating using the GLONASS and GPS systems in a joint Global Navigation Satellite System (GNSS) that can support the civil aviation community with the integrity that is required to provide for precision approach landings. The Russian Federation is now launching a second generation of GLONASS satellites, GLONASS-M, which is operating over 24 channels in the 1596.7-1620.6 MHz band. GLONASS-M has not been coordinated internationally. Approximately 40 administrations, including the United States, have submitted comments or objections to the ITU Radiocommunication Bureau with respect to GLONASS-M. However, the Russian Federation has been coordinating the GLONASS-M system and has indicated that it has resolved most of

negotiations regarding the use of GLONASS and were encouraged that even if GLONASS were ultimately used to provide services incompatible with MSS, the GLONASS final frequency plan would be changed to bands below 1606 MHz only, making the 1610-1616 MHz band available for MSS operations.[58] We recognized, however, that a GLONASS transition to bands below 1606 MHz may not be completed when the first MSS satellites are launched in the late 1990's. In that case, we stated we would need to develop a transitional plan for MSS migration into the vacated 1610-1616 MHz band "with MSS licensees operating on less than the full amount of their assigned spectrum during the initial phases of their operation."[59]

50. The applicants agree in their Joint Proposal that if GLONASS is not moved in a timely manner, the Big LEO licensees should share the burden of any spectrum loss. They argue, however, that we need not develop a transitional plan now, but, rather, that we should allow the parties to negotiate and reach such an agreement in the event GLONASS compromises MSS operations. Both Motorola and LQP argue in their comments that an interim plan would impede MSS by suggesting to GLONASS equipment manufacturers and other countries that they need not plan for the change in GLONASS frequencies and may lead to the view that revision of the GLONASS frequency plan is optional.

51. Our ongoing discussions with other agencies and with the Russian Federation continue to clarify the GLONASS issue. While we are confident that GLONASS will be moved to bands below 1606 MHz, we do not know when a full transition will occur. At our most recent bilateral discussions, the Russian Federation suggested that a GLONASS migration may not begin until 1998 and may not be completed until 2005.[60] We do not know whether GLONASS operations, before a migration to the final frequency configuration, will affect MSS CDMA systems operating in the lower frequency portion of the 1.6 GHz band, domestically or internationally. This depends upon two related factors: (1) the extent to which domestic and international civil aeronautical agencies and organizations (such as ICAO) use GLONASS to

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the objections by these administrations.

[58] The Russian Federation has indicated a willingness to use channels 0-12 (1602-1608.75 MHz center frequency) commencing in 1998. A guardband of approximately 4 MHz would be required to protect GLONASS-M narrowband signals from ground-based Mobile Earth Station (MES) out-of-band radio frequency emissions on aviation GNSS receivers using GLONASS signals.

[59] Notice, note 2, supra, at n.59.

[60] The Russian Federation has indicated that it can operate on channels -7 to +6 after 2005 (1598 to 1605.375 MHz center frequency). It has also indicated that it would only use channels 5 and 6 as technical channels over the Russian Federation. When this is implemented, GLONASS's highest effective operational channel will be 1604.25 MHz center frequency. Allowing for a 4 MHz guard band, there will then be no restrictions on MSS in the 1.6 GHz band.

provide approach and terminal communications that are incompatible with MSS operations and (2) the extent to which out-of-band emission limitations may be needed for MSS transmissions.[61] Nevertheless, a portion of the 1.6 GHz MSS frequency band may not be available for first-generation domestic MSS operations. At this time, the most likely worst-case scenario is that the 1610-1612 MHz band segment assigned to CDMA systems in our sharing plan may not be available for initial operations in the United States.[62] This is based on the launch and operation schedules outlined in the various applications.

52. We agree with the applicants that the burden of the potential 2 MHz shortfall should be shared among all 1.6/2.4 GHz MSS licensees. We believe, however, that a transitional plan is warranted. Such a plan will allow system launch to begin without potential delay and without the uncertainty associated with allowing the licensees to attempt to devise an interim plan on an ad hoc basis, as the Joint Proposal suggests.[63] In adopting an interim plan, we emphasize that we remain optimistic that the plan will not need to be implemented. Indeed, as provided in the Joint Proposal, all Big LEO operators will be authorized to construct systems capable of operating across the entire band allocated for that system architecture, that is, 1610-1626.5 MHz for CDMA systems and 1616-1626.5 MHz for bi-directional FDMA/TDMA systems. Further, even if the transitional plan is implemented, MSS operators will be permitted to expand into the unused 1.6 GHz MSS frequencies immediately after the GLONASS migration is completed. We

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[61] RTCA, Inc., an advisory committee to the FAA, is studying out-of-band emissions from mobile earth stations among other potential interference sources to GNSS receivers. RTCA, Inc. has formed an Ad Hoc Interference Subgroup (AHIS) of Special Committee 159 (SC-159) on Global Positioning Systems. A special Joint Task Group on SATCOM/GNSS Interference is also studying the mutual problems of electromagnetic compatibility of AMSS and GPS/GLONASS equipment operating on the same platforms or on platforms located at very close distances, i.e., airport terminals. See para. 137, infra.

[62] We note that to the extent MSS systems are launched before 1998, the 1610-1616 MHz portion of the 1.6 GHz band segment might not be available if GLONASS is being used in the GNSS for aeronautical operations. In that case, licensees can begin to implement channels starting from the highest frequency range downwards in conformance with the interim plan. We believe that this should not present significant problems since it will occur at the earliest stages of operations. We also note that it is possible that the FAA will decide not to use GLONASS until it shifts its frequencies to its final configuration. It may be prohibitively expensive for airlines to develop and install equipment using interim standards capable of protecting equipment using GLONASS. In that event, we believe that it is likely that the Russian Federation will advance the date to shift GLONASS frequencies to channel 6 and below as early as possible. The most recent bilateral discussion with the Russian Federation provides for periodic review of this time table and the deployment of the MSS systems in order to resolve any interference.

[63] We will, however, entertain a request for modification of the interim plan if agreed to by all licensees.

believe that any necessary transition among LEO licensees can be completed within six months of that date.

53. Our interim plan is based upon the most recent system designs presented to us in the context of the Negotiated Rulemaking. Four of the CDMA applicants propose to build systems using narrowband 1.25 MHz transmission channels while one -- TRW -- proposes wider 5 MHz channels. If the entire 11.35 MHz assignment designated for CDMA systems were available, the narrowband licensees would be able to operate over 9 transmission channels, while the wider band operator would be able to operate over two. If MSS cannot be provided in the 1610-1612 MHz portion of the CDMA band segment because of GLONASS considerations, two narrowband channels would be lost and one wideband channel would be lost. Allowing CDMA licensees to shift frequencies by 1.25 MHz into the designated TDMA/FDMA band at 1621.35-1626.5 MHz would provide both narrowband and wideband CDMA licensees with access to one additional channel. Consequently, until the entire 1610-1626.5 MHz band is available for MSS operations, we will provide CDMA operators with the option of operating in the 1621.35-1622.60 MHz band segment. In this way, all Big LEO operators will bear some of the necessary operating constraints -- the narrowband CDMA operators by the net loss of one channel, the wideband CDMA operators by the loss of one channel or by the need to retune the center frequencies on both of its channels once GLONASS is fully moved,[64] and the FDMA/TDMA licensee by the loss of operating bandwidth. Nevertheless, we are optimistic that these measures will not be necessary or, if they are, that the effect on the MSS industry will not be significant given their short term nature and the anticipated incremental implementation of Big LEO service.

e. Conditions to the Plan

i. Reduction in Spectrum for Single CDMA System:

54. Another issue raised by the LEO applicants is our proposed modification to the plan in the event only one CDMA licensee goes forward.[65] In this unlikely scenario, we proposed to reduce the bandwidth assigned to that system automatically from 11.35 MHz to 8.25 MHz.

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[64] The additional interim bandwidth of 1.25 MHz (1621.35-1622.60 MHz) would allow TRW to operate two 5 MHz CDMA channels at 1612.60 MHz to 1617.60 MHz and 1617.60 MHz to 1622.6 MHz. If it chooses to do this, it would be required to move these channels to 1610 to 1615 MHz and 1615 to 1620 MHz once GLONASS is moved. This would require the center frequencies on each channel to be shifted or retuned.

[65] Under the terms of each authorization, Big LEO licensees will be required to meet specified implementation milestones for the system. Failure to meet these deadlines will render the authorization null and void. See para. 189, infra. The bandwidth adjustment discussed here would be triggered only: (1) if no CDMA system is licensed; (2) if only one CDMA system is licensed; or, (3) if more than one CDMA system is licensed and all but one is declared null and void.

We stated that an 8.25 MHz assignment, or one-half of the available 1.6 GHz MSS allocation, should be sufficient to support a viable system. We noted that the remaining 3.1 MHz of spectrum would be made available to an operational FDMA/TDMA system upon a showing of need or, if this demonstration could not be made, to a new entrant. The four parties to the Joint Proposal suggest that if one CDMA and one FDMA/TDMA system become operational, the 3.1 MHz of spectrum should be available to both of these licensees upon a showing of need and should not be made available to new entrants. In their comments, the CDMA operators argued that an automatic spectrum reduction for a CDMA system with no possibility of adjustment would penalize a CDMA licensee for the failure of another operator to launch a system, that it does not consider the efficiency of the system or whether the CDMA system is sharing spectrum with a foreign system, that it does not give CDMA operators a corresponding opportunity to gain access to bands above 1621.35 MHz upon failure or inefficient spectrum use by the FDMA/TDMA licensee, and that it will seriously impair CDMA operations. They further argued that even if GLONASS is moved, the lower frequency portion of the band is subject to more interservice sharing constraints because of protected radio astronomy operations.

55. The CDMA proponents correctly state that uncertainties are present in the lower portion of the band that are not present in the upper portion. As noted, GLONASS is now operating in 1610-1616 MHz band and we do not know exactly when it will be moved or the limitations its operations will impose on MSS operations. Further, the radioastronomy service (RAS) operates on a co-primary basis in the 1610.6-1613.8 MHz band. The agreement reached by the Negotiated Rulemaking Committee regarding sharing between RAS and MSS imposes restrictions on MSS operations provides certain operating constraints on MSS mobile earth terminals in geographic areas near RAS sites.[66] If RAS sharing proves burdensome or if GLONASS is not fully moved in a timely fashion, an assignment of 8.25 MHz for each of the two LEO system architectures may not prove equivalent. Further, we do not know if, and the extent to which, foreign systems will impact U.S. systems' operations across the entire band. Consequently, we will defer any decision with respect to the 3.1 MHz between 1618.25 and 1621.35 MHz until, and if, either of those contingencies arises. At that time, we will have a clearer notion of the extent of any inter-service sharing constraints in the lower portion of the 1.6 GHz band. We will not, however, limit our consideration for assignment of this band to the two licensed systems, as the parties to the Joint Proposal urge. We do not think it is advisable at this time to preclude new entrants from access to this band. Rather, we will make the decision with respect to the 3.1 MHz, if necessary, in the context of a rulemaking, based upon the circumstances that have developed at that time.

ii. Other Potential Scenarios

56. Although not specifically addressed in the Notice, the four parties to the Joint Proposal have developed a plan in the event that only one system retains a construction permit.

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[66] See paras. 101 - 109, infra.

In this scenario, the Joint Proposal would provide that that system, whether TDMA/FDMA or CDMA, would be given access to the entire 16.5 MHz of bandwidth.

57. We need not decide now on a course of action to be taken in the event that only one Big LEO system is implemented, whether it is a CDMA or TDMA/FDMA system. If and when that occurs, we will weigh a variety of factors in a rulemaking, including our preference for multiple entry, constraints on the assigned spectrum due to international coordination agreements, system efficiency, and system loading, when considering a spectrum adjustment for that system.

f. System Amendments

58. Several of the commenters question whether applicants will be permitted to change their system designs when amendments are filed. TRW, for example, asks us to clarify that a change in transmission techniques from CDMA to TDMA/FDMA following adoption of service rules will not constitute a major amendment under Commission rules. This concern apparently stems from Section 25.116(c) of our rules, which provides, in general, that any pending application is to be considered a newly filed application if it is amended by a major amendment after a "cut-off" date. The rule contains several exceptions, including instances where the amendment resolves frequency conflicts with other pending applications, but does not create new or increased frequency conflicts.[67]

59. We have repeatedly emphasized that MSS Above 1 GHz applicants who filed by the cut-off date will be afforded an opportunity to amend their applications, if necessary, to bring them into conformance with any requirements and policies that are adopted for satellite systems in these bands.[68] Thus, a change from a GSO system configuration to a LEO system configuration to meet our satellite system design requirement or a change in coverage patterns to conform with our satellite visibility requirements would be permitted without affecting a particular application's status in this processing group. However, a change that is not necessary to bring the application into conformance with our rules and which would increase frequency conflicts, such as a change from a CDMA to a TDMA/FDMA architecture, would render the application a newly filed application to be considered in a future processing group.[69] We recognize that if all six of the pending applicants are found qualified under our Big LEO rules, our five-system sharing plan will not be able to accommodate all of them. We discuss in a

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[67] 47 C.F.R. § 25.116(c)(1).

[68] See Notice, note 2, supra, at para. 18 and Public Notice, note 16, supra.

[69] We note that the three CDMA applicants participating in the Joint Proposal have agreed not to change to a TDMA/FDMA architecture.